# TANDBERG television

Part of the Ericsson Group



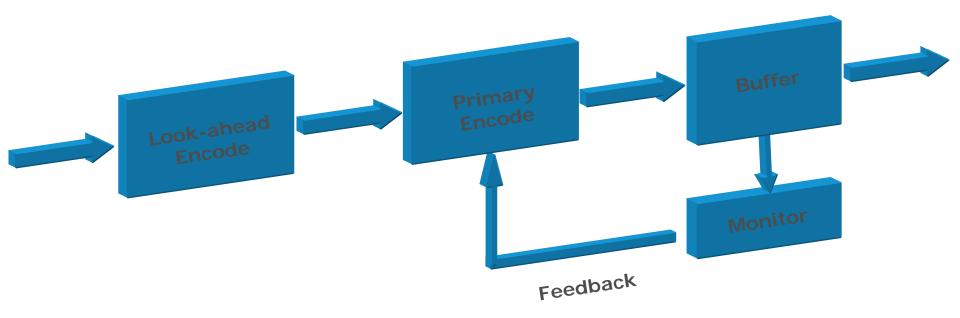
# "It's Not Dead Yet!" MPEG-2 Video Coding Efficiency Improvements

National Association of Broadcasters
Broadcast Engineering Conference
April 22, 2009

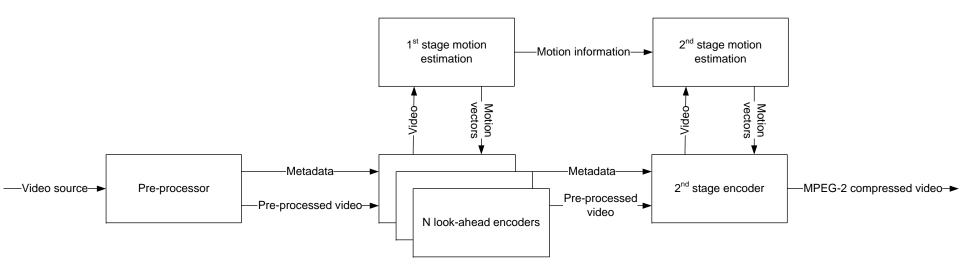
## Why improve MPEG-2 Video coding?

- Industry "buzz" over the past ~5 years has been new compression technologies to replace the ubiquitous MPEG-2 Video
- Yet, there are still over 1 billion MPEG-2 only STBs and DTV sets
  - Multichannel programming video distributor (MPVD) commercial justification to migrate MPEG-2 SD only STBs to MPEG-4 AVC already questioned
  - Some world regions have delayed entry into HD DTH distribution due to economic conditions
  - USA & other OTA broadcasters required by government regulation and many millions of DTV receivers to use MPEG-2 Video format only
- And, DTH bandwidth is a "scarce resource"
  - How to support new ATSC Mobile DTV service without impacting existing services?

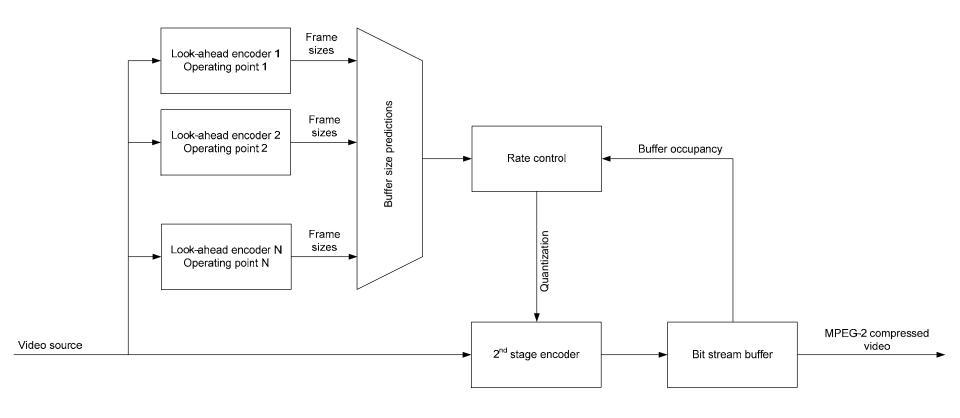
# **Existing MPEG-2 Video encoders**



## Pre-processing & 2-stage motion estimation

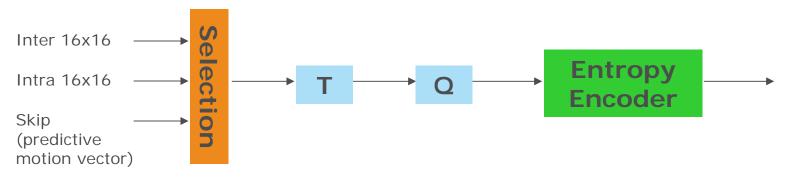


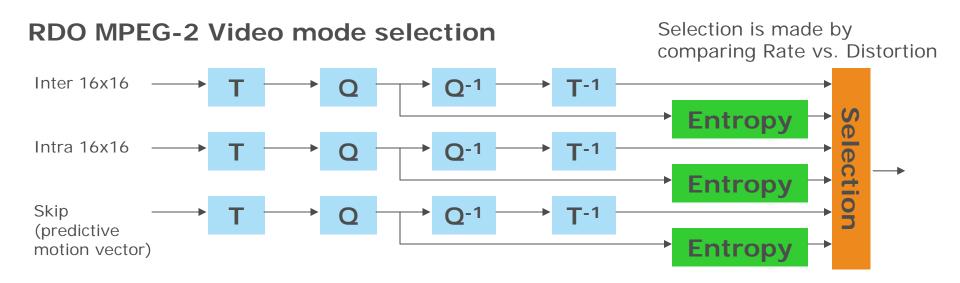
## Multiple look-ahead encoders



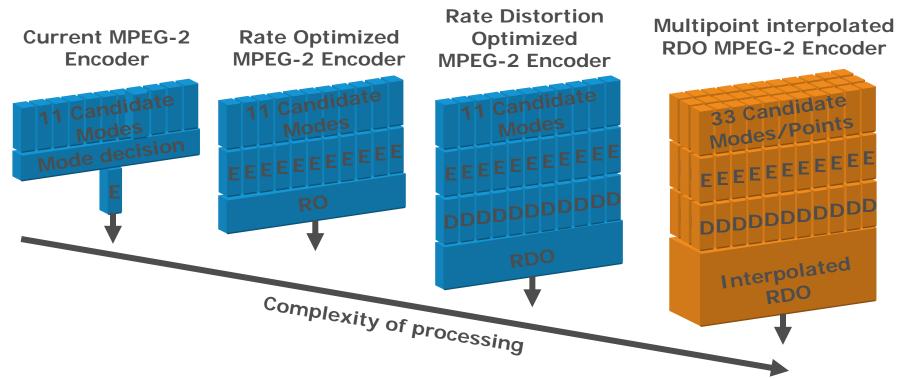
### Rate Distortion Optimization (RDO)

#### Conventional MPEG-2 Video mode selection





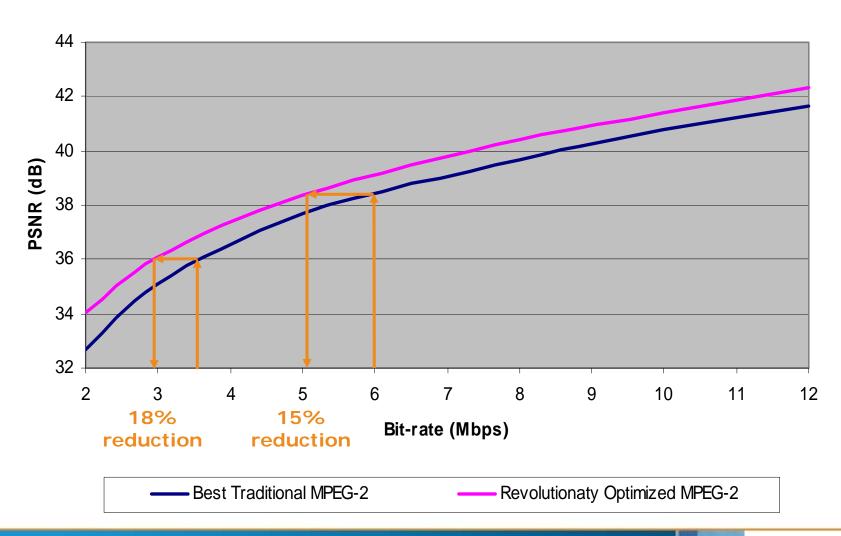
### Multipoint interpolated RDO



- Adds dozens of operating points with higher and lower quality references
- Interpolation between operating points to deliver the most optimal and exhaustive decision possible
- Dozens of encodes & decodes, performed in parallel

# Comparison of bit-rate efficiency for real-time sports

#### **Sports Material Experiment**



## **CBR** test sequences



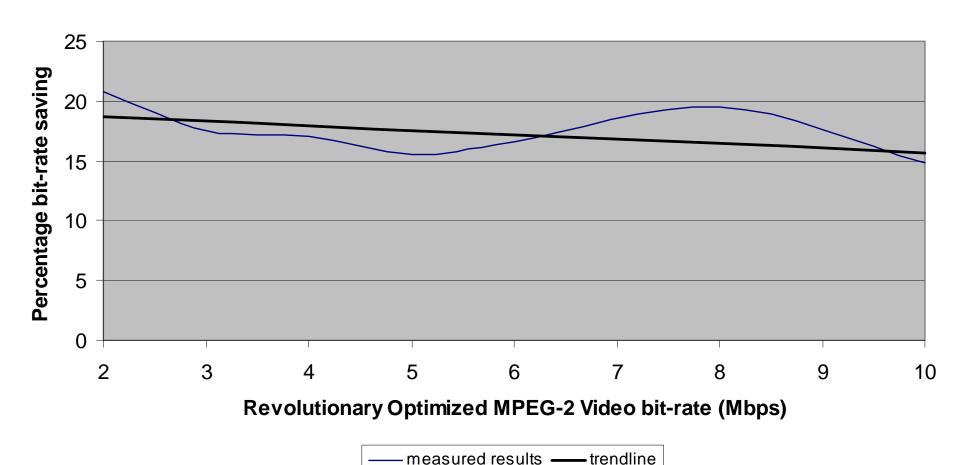




- Mobile and Calendar
- Soccer
- Kiel harbor

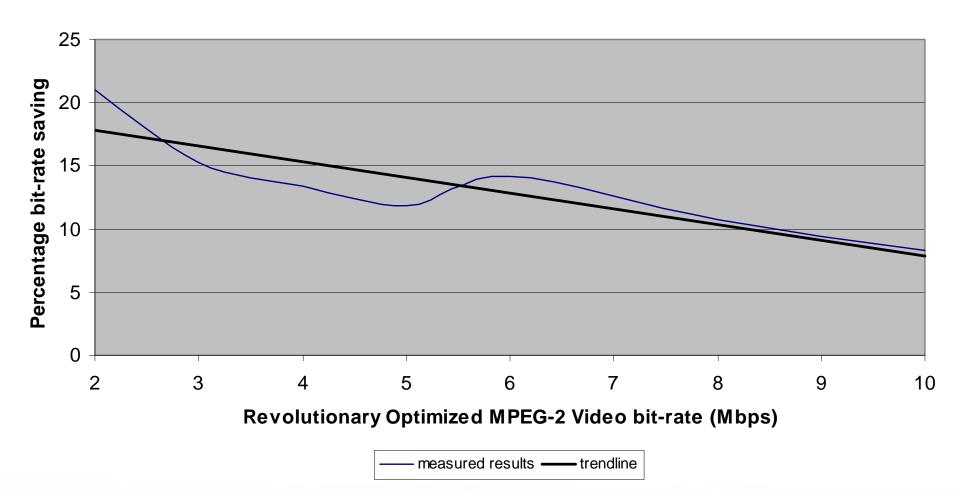
# Bit-rate savings in field/frame mode

#### Bit-rate saving field/frame mode



# Bit-rate savings in frame only mode

#### Bit-rate saving frame mode



### Stat mux test sequences











- Sport, Football Sport, Rugby Film
- Studio, Sitcom Studio, Music video

# Revolutionary optimized stat mux vs. traditional stat mux

|   | sport1 | sport2 | film3 | studio4 | studio5 |
|---|--------|--------|-------|---------|---------|
| Revolutionary Optimized (15% less bit-rate) | 68.17  | 60.16  | 74.9  | 62.69   | 74.66   |
| Traditional MPEG-2                          | 64.78  | 57.96  | 75.07 | 63.03   | 74.3    |
| DVQ diff                                    | 3.39   | 2.2    | -0.17 | -0.34   | 0.36    |

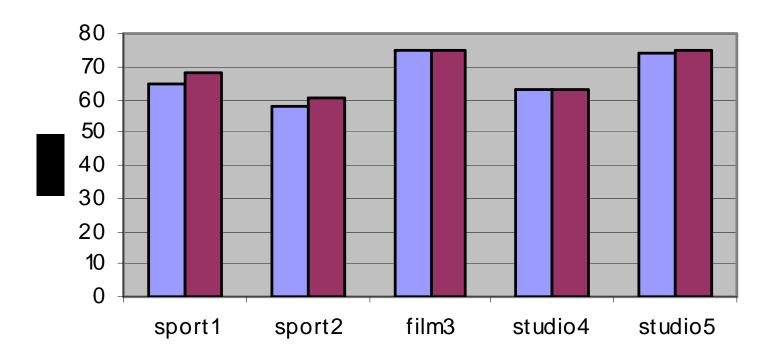
|   | sport1 | sport2 | film3 | studio4 | studio5 |
|---|--------|--------|-------|---------|---------|
| Revolutionary Optimized (15% less bit-rate) | 75.4   | 66.02  | 80.92 | 71.96   | 76.61   |
| Traditional MPEG-2                          | 70.77  | 63     | 78.18 | 68.01   | 77.56   |
| DVQ diff                                    | 4.63   | 3.02   | 2.74  | 3.95    | -0.95   |

• 
$$GOP = 12$$

• 
$$GOP = 36$$

# DVQ comparison of statmux, GOP length 12

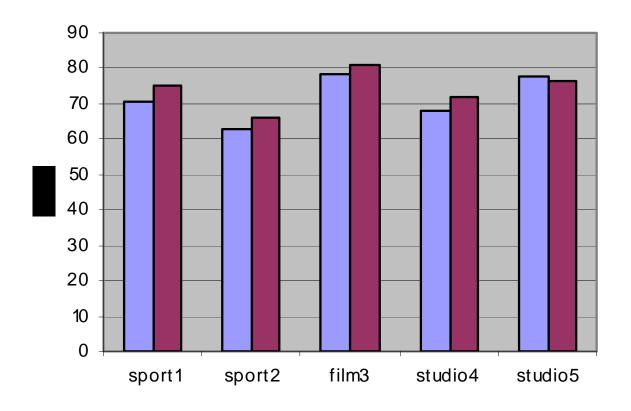
#### DVQ Comparison of Statmux (GOP length 12)



- Traditional (GOP12) @ 12.5Mbps
- Revolutionary Optimized (GOP12) @ 10.625Mbps

# DVQ comparison of statmux, GOP length 36

#### DVQ Comparison of Statmux (GOP length 36)



- Traditional (GOP36) @ 12.5Mbps
- Revolutionary Optimized (GOP36) @ 10.625Mbps

### **Conclusions/Summary**

- With advances in technology (Moore's Law) and new algorithms applied, MPEG-2 Video encoding can be improved/optimized greatly over all existing MPEG-2 encoder implementations
- Picture quality measurements demonstrate that the "revolutionary optimized" MPEG-2 Video encoder has achieved significant bit-rate reductions, with minimum savings in excess of 15%
- With over 1 billion MPEG-2 Video legacy receivers fielded, regulatory and practical requirements to continue MPEG-2 broadcasting, and the need to support more services (HD, mobile) in existing bandwidth, the need to improve MPEG-2 Video compression is critical

### **Acknowledgements**

- Many thanks to my TANDBERG Television colleagues for their assistance with this paper
  - -Alois Bock
  - -Matthew Compton

# Thank you ... Questions?

